

WHAT IS CLAIMED IS:

1. A cold forging apparatus for performing multiple functions at a single station to form complex shapes, said apparatus comprising a first multiple function punch assembly including a first inner punch and a first outer punch movable along a common axis with respect to one another, a second movable punch assembly including a second inner punch and a second outer punch movable along a common axis with respect to one another, means for moving said punches individually along said common axes, and means for positioning a die between said first multiple function punch and said second multiple function punch assemblies for receiving and containing a mass of material therein to be acted upon by said punches to thereby form a complex shape.

2. A cold forging apparatus for performing multiple functions at a single station to form complex shapes according to claim 1, which includes a programmable logic controller, multi access controller and feedback devices for controlling movement of said punches individually along said common axes.

3. A cold forging apparatus for performing multiple functions at a single station to form complex shapes according to claim 1, in which said first and said second multiple function punches are disposed and movable along one common axis.

4. A cold forging apparatus for performing multiple functions at a single station to form complex shapes according to claim 3, in which said second inner punches have a circular cross section.

5. A cold forging apparatus for performing multiple functions at a single station to form complex shapes according to claim 3 in which said second inner punch has an irregular cross section.

6. A cold forging apparatus for performing multiple functions at a single station to form complex shapes according to claim 4, in which said first and said second outer punches

have a circular ring-shaped cross section and which surround said first and second inner punches respectively and in which said outer and said inner punches are in sliding contact with one another.

7. A cold forging apparatus for performing multiple functions at a single station to form complex shapes according to claim 4, in which one of said outer punches is adapted to extend over an opposite one of said inner punches.

8. A cold forging apparatus for performing multiple functions at a single station to form complex shapes according to claim 4, in which each of said outer punches is adapted to extend over an opposite one of said inner punches.

9. A cold forging apparatus for performing multiple functions at a single station to form complex shapes according to claim 3, in which said means for positioning a die between said first and said second multiple function punch assemblies is movable along said common axis.

10. A cold forging apparatus for performing multiple functions at a single station to form complex shapes according to claim 5, which includes means for inserting a metal slug to be acted upon between said first and said second multiple function punch assemblies.

11. A cold forging apparatus for performing multiple functions at a single station to form complex shapes according to claim 6, which includes means for inserting a metal slug to be acted upon between said first and said second multiple function punch assemblies.

12. A cold forging apparatus for performing multiple functions at a single station to form complex shapes according to claim 3, in which said means for separately moving said punches individually along said common axis includes a programmable logic controller, multi access controller with feedback devices and software for defining the complex shape.

13. A cold forging apparatus for performing multiple functions at a single station to form complex shapes, said apparatus comprising a multiple function punch assembly including an inner punch and an outer punch movable along a common axis with respect to one another, said outer punch assembly has a multiple ended cylinder including a seal at each end and a passageway extending through the multiple ended assembly, and an extended rod connected to said inner punch extending through said passageway and means for separately controlling the movement of each of said punches.

14. A method for forming complex metal shapes at a single station comprising the steps of:

providing a first multiple function punch assembly including an inner punch and an outer punch;

providing a die;

moving the inner and outer punches along a common axis into and out of the die; and

controlling the movement of each of the punches to act independently on a workpiece within the die.

15. A method for forming complex metal shapes at a single station according to claim 15 which includes the step of controlling each of the punches to act simultaneously synchronously or sequentially on a workpiece.

16. A method for forming complex metal shapes at a single station according to claim 14 which includes the step of providing a double-ended cylinder having two ends and a double-ended rod, forming a seal at each of the two ends and forming a passageway extending through the double-ended rod, and providing an extended rod for the inner punch with the extension passing through the passageway.

17. A method for forming complex metal shapes at a single station according to claim 14 which includes the steps of:

providing a second movable punch assembly including a second inner punch and a second outer punch in a coaxial confronting relationship with the first punch assembly; and

controlling the movement of each of the punches in each of the assemblies to act on a workpiece.

18. A method for forming complex metal shapes at a single station according to claim 17 and which includes the steps of:

exerting pressure on a workpiece by one of the punches in each of the multiple punch assemblies and subsequently applying pressure on the workpiece by one of the other punches to thereby form a metal part.

19. A method for forming complex metal shapes at a single station according to claim 18 which includes the step of:

moving one of the punches away from the metal workpiece to thereby form a cavity in the die before applying pressure by another of the punches to thereby allow the workpiece to expand into the cavity formed by the movement of one of the punches.

20. A cold forging apparatus for performing multiple functions at a single station to form complex shapes according to claim 13 which includes an anti-rotation mechanism for preventing rotation of said outer punch.

21. A cold forging apparatus for performing multiple functions at a single station to form complex shapes, said apparatus comprising:

a first multiple function punch assembly including a first inner punch and a first outer punch moveable along a common axis with respect to one another;

a third moveable punch moveable along a second axis;

means for moving said punches individually along said axes;

means for positioning a die for receiving a mass of metal and for action upon said mass of metal in response to movement of said punches to thereby form a complex shape at a single station.

22. A cold forging apparatus for performing multiple functions at a single station to form complex shapes according to Claim 21 in which said axes are parallel but linearly

offset from one another whereby said first and second punches impact on one portion of a metal mass and said third punch impacts on another portion of the metal mass.

23. A cold forging apparatus for performing multiple functions at a single station to form complex shapes according to Claim 21 in which said common axis and said axis of said third punch are angularly offset from one another but constructed and arranged so that each of said punches impact on a mass of metal at a single station.

24. A cold forging apparatus for performing multiple functions at a single station to form complex shapes according to Claim 21 in which said third punch is a second multiple function punch assembly including a second inner punch and a second outer punch moveable along a common axis.

25. A cold forging apparatus for performing multiple functions at a single station to form complex shapes according to Claim 24 in which said second multiple function punch assembly is in a generally confronting relationship with said first multiple function punch assembly.

26. A cold forging apparatus for performing multiple functions at a single station to form complex shapes according to claim 25 in which said first and said second punch assemblies are disposed on a common axis and adapted to impact on opposite sides of said mass of metal.

27. A cold forging apparatus for performing multiple functions at a single station to form complex shapes according to claim 21 which includes an additional punch moveable along an axis so that said additional punch impacts on a different portion of the mass of metal.

28. A cold forging apparatus for performing multiple functions at a single station to form complex shapes according to Claim 27 in which said additional punch is a multi

functional punch assembly including a third inner punch and a third outer punch moveable along a common axis with respect to one another.